In sum, an ideal book for those mathematicians and statisticians who wish an introduction to the fundamental ideas of queueing theory, and for those workers in applied fields who wish a masterful analysis of concepts too often taken for granted.

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The Passage Problem for a Stationary Markov Chain. By J. H. B. KEMPERMAN. Statistical Research Monographs, Vol. 1, Univ. of Chicago Press, 1961. 127 pp. $5.00.

As the author states in his introductory remarks this monograph has as its purpose the development of certain methods for treating first passage and absorption phenomena in stationary Markov chains. Let $\mathcal{Z} = \{z_0, z_1, \cdots, z_n, \cdots\}$ be a stationary Markov chain with a denumerable number of states $0, \pm 1, \pm 2, \cdots$ (z_n = the position of the particle at time n) and transition probabilities $P_{ij}^{(1)}$. The principal technique that is employed in this monograph is the introduction of a random event $\mathcal{A}$ (called absorption) which can occur at times $0, 1, 2, \cdots$. The conditional probability that $\mathcal{A}$ occur at time n, given $z_n = i$, is specified to be $1 - \rho(i)$ where the $\{\rho(i)\}$ are real numbers in $[0, 1]$. Let $Q_{ij}^{(n)}$ denote the conditional probability given $z_0 = i$, that $z_n = j$ and no absorption has occurred at any of the instants $0, 1, 2, \cdots, n - 1$. By a judicious choice of the $\{\rho(i)\}$ many different absorption phenomena can be treated. For instance, let $\mathcal{S}$ be a set of states and suppose $\rho(i) = 1$ if $i \not\in \mathcal{S}$ and $\rho(i) = 0$ if $i \in \mathcal{S}$. In this case $Q_{ij}^{(n)}$ is the conditional probability, given $z_0 = i$, that you have gone to state j in n steps avoiding the "taboo" states $\mathcal{S}$. An application of this technique is given in Section 5 where the author derives exact formulas for the Kolmogorov–Smirnov test. In the Bernoulli case $\mathcal{Z} = \{z_n\}$ is a process of independent increments and $X_n = z_n - z_{n-1} \in \{-1, 1\}$ and the following holds: $Pr\{X_n = +1\} = p = 1 - Pr\{X_n = -1\}$. For a fixed integer $c > 0$ set $\rho_0 = \rho_c = 0$ and $\rho_j = 1$ otherwise. The author derives two formulas for $\pi_{ik}^{(n)}$ = the conditional probability, given $z_0 = i$, that $z_n = k$ and $z_m \not\in \{0, c\}$ for $0 \leqq m \leqq n$.

The author next extends this method to the stationary Markov chain of real-valued random variables and shows a connection between the absorption phenomena and a class of integral equations. In Sections 10–12 generalizations of the fundamental identity of Wald are treated. Occupancy Times, Queueing Problems, and Collective Risk Theory are some of the applications considered by the author.

An extremely considerable amount of material has been concentrated in a very short monograph, and the style of the book is correspondingly concise.

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Cybernetics, or Control and Communication in the Animal and the Machine, Second ed. By NORBERT WIENER. M.I.T. Press and Wiley, New York and London, 1961. xvi + 212 pp. $6.50.

Grateful sons are not too qualified to evaluate their fathers, and we in this Journal do not feel qualified to evaluate this great book: here were first described many of the research topics which we have attempted to carry out, it would be improper to say in public that our research topics are so important; it would also be unwise to stress our inadequacy in carrying some of them out. Suffice therefore to point out that the second edition has been completely reset and proofread and two new chapters were added, one on "Learning and Self-Reproducing Machines" and the other on "Brain Waves and Self-Organizing Systems." Our readers undoubtedly already own their copy.

Book Review Editor

Iterative Arrays of Logical Circuits. By FREDERICK C. HENNIE, III. The M.I.T. Press and Wiley, New York, 1961. 242 pp. $4.95.

This book, the eleventh of a series of M.I.T. Press Research Monographs, is essentially the author's Ph D. thesis. He generalizes iterative circuits from previously studied one-dimensional unilateral circuits to systems of circuits having higher dimension and having interconnections in more than one direction. He treats several topics in these systems and, in particular, proves some undecidability theorems. The book is for specialists, particularly those doing research in automata or switching theory. Also, some of the synthesis techniques presented in chapters 7 through 10 are applicable to certain types of logical design problems.

In chapter 1 the definitions for the structure of iterative networks are given. Basically, an iterative network is a regular array of a finite number of identical subnetworks, or *cells*, in n-dimensional Euclidean space, where the cells are placed at points having integer coordinates. Certain boundary conditions on the structure are also required. An iterative *system* is the class of finite networks having a particular cell structure and boundary conditions. Both equilibrium and transient behavior are then described for fixed values of the primary inputs to a network or system. Most of the book is concerned with equilibrium behavior. If a network is represented by a transition diagram, then a state of the network is called an *equilibrium state* for some fixed primary input pattern if the network state has a cycle of length one for that primary input pattern in the transition diagram. If a network has exactly one equilibrium state for each pattern of primary inputs the network is called *regular*. A network which has no state cycles greater than one for any pattern of primary inputs is called *stable*. Two regular networks which have the same number and arrangement of cells are called *equivalent* if for each primary input pattern the primary output patterns are identical, when the two networks are in their equilibrium states with the same input pattern being applied to both networks. The notions of regularity, equivalence, and stability for networks and systems play a central role in the later chapters.

In chapter 2 a study of decidable systems is made. A class of systems is *decidable* if there exist finite tests for determining regularity and equivalence of the systems. Here the author shows that one-dimensional systems of combinatorial cells are decidable, and he extends his techniques to certain types of multidimensional systems which are decidable.

In chapter 3 some very interesting undecidability results are obtained by relating certain two-dimensional iterative systems to the Post correspondence problem which Post has shown to be recursively unsolvable. A sequence of un-